ISSN 0332-1789

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# EXPLOITATION AND SURVIVAL OF REARED SALMON RELEASED INTO THE BURRISHOOLE RIVER SYSTEM

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Fishery Leaflet 161

Dublin 1994

ISSN 0332-1789

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*Fishery Leaflet* 161 *May 1994*

Department of the Marine Dublin 2

***Summary***

Hatchery reared salmon smolts have been microtagged using binary coded nose tags and released into Irish rivers since 1980. These tagged fish are intercepted and identified in high seas coastal fisheries and in Irish rivers as adult salmon. The tag recovery programme provides valuable information on the marine survival and exploitation rates of these tagged fish and the return rates back to the river of origin. This leaflet summarises the results for release groups of reared indigenous salmon from the Burrishoole system in Co. Mayo.

Marine survival prior to homewater exploitation has been very variable in the period examined. Although homewater marine exploitation rates have varied considerably depending on the fishing areas, they remained high for all areas combined between the years 1982 to 1989 with exploitation rates by coastal fisheries up to 87%. The greater part of the catch is taken in the Mayo area. Exploitation rates have decreased since 1989 and approximately 60% of the returning stock is estimated to have been caught in coastal fisheries in 1993. Survival to the river has also varied with an average of 2.5% of the total number of smolts released returning as adults to the river.

## INTRODUCTION

The microtag recovery programme was initiated in 1980 to provide information on the exploitation rates by commercial and recreational fisheries, based on recaptures of tagged reared and wild smolts. Tagging of smolts from nine rivers located around the western seaboard has been carried out annually using binary coded wire nose tags. Details of tagging and recovery information are available from the Fisheries Research Centre.

The Burrishoole is a short river which flows into Clew Bay in Co. Mayo, in the west of Ireland. The total catchment area is 111 $km^2$ ( 43 square miles). A description of the physical characteristics of the system is given by Piggins (1985).

Since 1970 there has been a full upstream and downstream counting facility for salmon on the Burrishoole. The total counts of upstream migrating reared fish and the numbers of tagged fish taken in the fishery are available from the relevant Annual Reports of the Salmon Research Agency of Ireland (formerly the Salmon Research Trust).

## METHODS

Reared salmon smolts were microtagged and adipose finclipped before being released into the system. Tag recoveries are generated from international high-seas fisheries in the Faroes and Greenland and from homewater fisheries (drift nets, draft nets, angling etc). Data on declared salmon landings in each of the corresponding areas are collected by the seven regional fisheries boards and compiled into a national dataset by the Department of the Marine. Salmon landings are also provided by the Foyle Fisheries Commission and tag recovery information is provided by the Department of Agriculture for Northern Ireland. The number of adult recaptures taken in these fisheries is estimated by multiplying the number of tags recovered in each fishery area (Figure 1) by the ratio of the reported commercial catch in these areas to the number of salmon examined. Over 12 tag recovery locations, covering fish dealers and processors are scanned for the presence of finclipped salmon. There is also a substantial non-catch fishing mortality (NCFM) associated with these fisheries which includes all sources of losses from nets and non-reporting of catches. An estimate of NCFM is derived annually from local knowledge and experience. This can then be used to expand the net recovered tags to indicate the total stock available at the time. Reported salmon catch figures for 1993 are provisional.

The total stock returning to the river is estimated by summing the counts of reared salmon in the upstream trap, together with those taken by the recreational fishery. For the purposes of this analysis it is assumed that the tags are randomly distributed throughout the fishery and that non-recognition or non-detection of tags is minimal. Exploitation is estimated by dividing the number of fish caught in a fishery by the number available to the fishery.

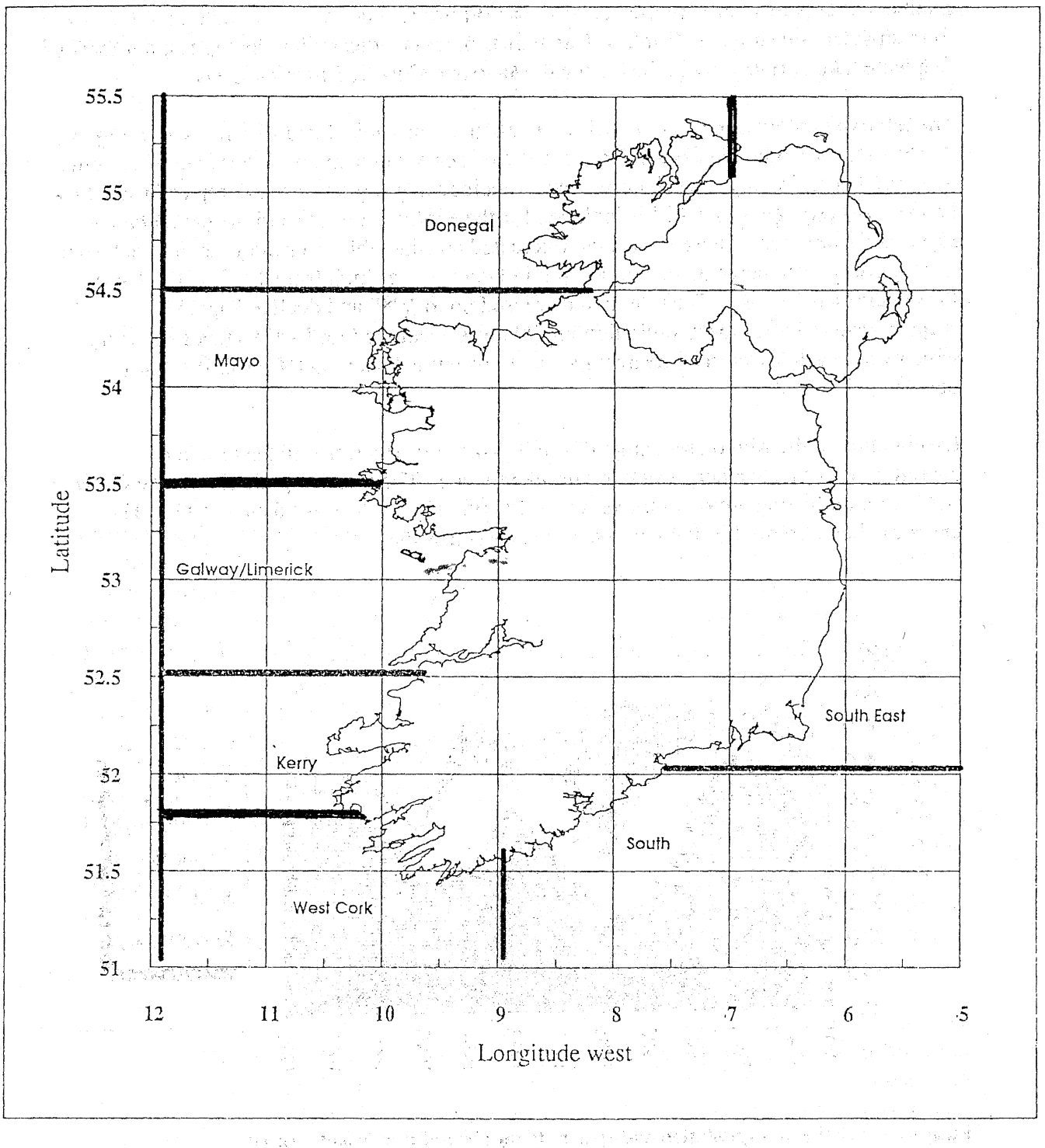


**Figure 1. Sampling areas named in the report.**

## RESULTS

The numbers of smolts released (estimated as the actual number migrating) and the numbers of tags recovered in the various sea fisheries around the coast, including returns to freshwater, are shown in Table 1. Catch distributions indicate that the highest numbers of fish were taken principally in the Donegal, Mayo and Galway/Limerick areas.

The relative exploitation rates on this stock are given in Table 2 and summarised in Figure 2. The category 'other' in Figure 2 refers to other sea area recaptures where tags were only recovered occasionally. The river recaptures include angling returns and trap or broodstock counts. An estimate of NCFM is included for the exploitation rate and the percentage survival to the coast. These rates have fluctuated considerably over the years and between fishing areas. The percentage exploitation in Donegal was high from 1982 to 1984 and then decreased in 1986. The rate then increased up to 1988 and declined again. Approximately 9% of the exploitation in 1993 was accounted for by the Donegal fishery which was much lower than the average catch from this fishery (21%) over the study period.

Exploitation in the Mayo area ranged from 9 to 42 % in 1993, the highest marine exploitation of this hatchery stock in this area to date. The mean exploitation in the Galway and Limerick fishing areas combined was 12% but only 3.5 % was taken in 1993. The mean exploitation on this stock in other areas was less than 5%.

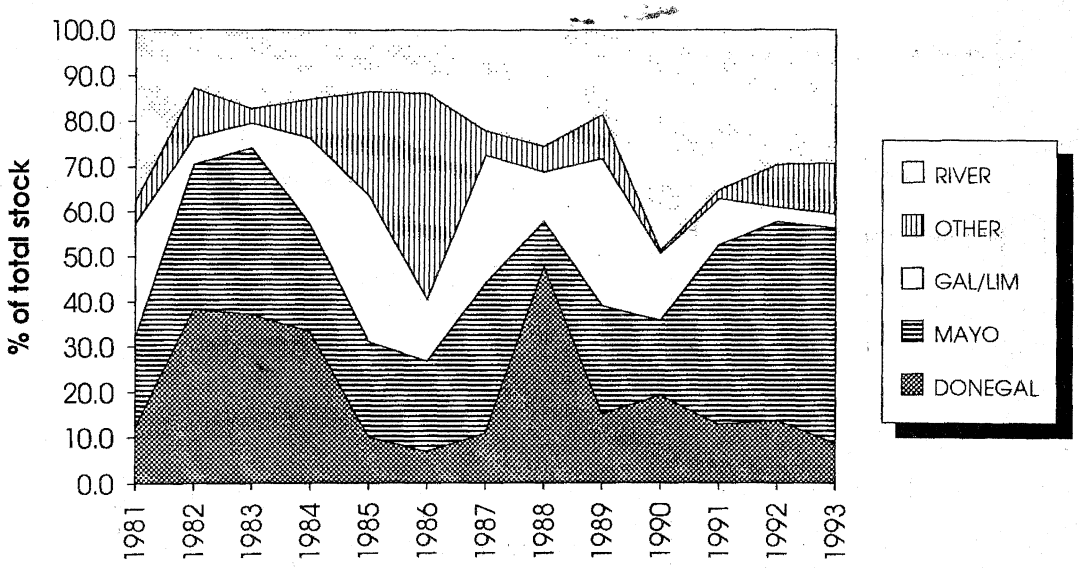


**Figure 2. Variation in exploitation and returns to the river of Burrishoole reared salmon (includes an estimate for NCFM)**

Overall, however, the rate of exploitation by nets, including and excluding NCFM, remained high but stable for the period 1982 to 1989 (Table 2, Figure 3) but recently declined. The exploitation rate in 1993, including NCFM, was approximately 71% of the total hatchery stock returning to homewaters. The rate of return to fresh water improved since 1989 (Figure 2) with approximately 30% or more of the homewater stock reaching the river.

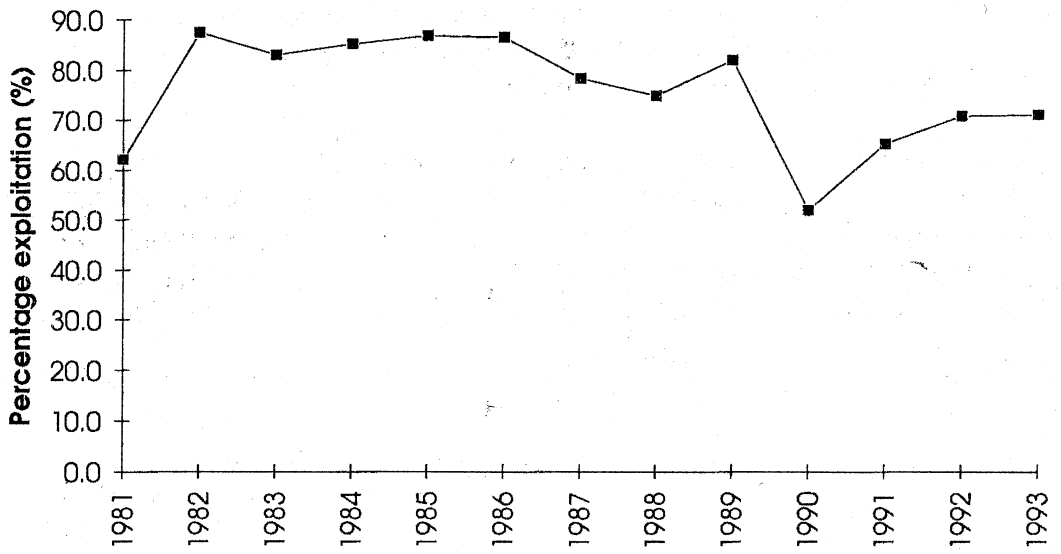


**Figure 3. Exploitation by commercial nets in Irish waters on Burrishoole reared salmon**

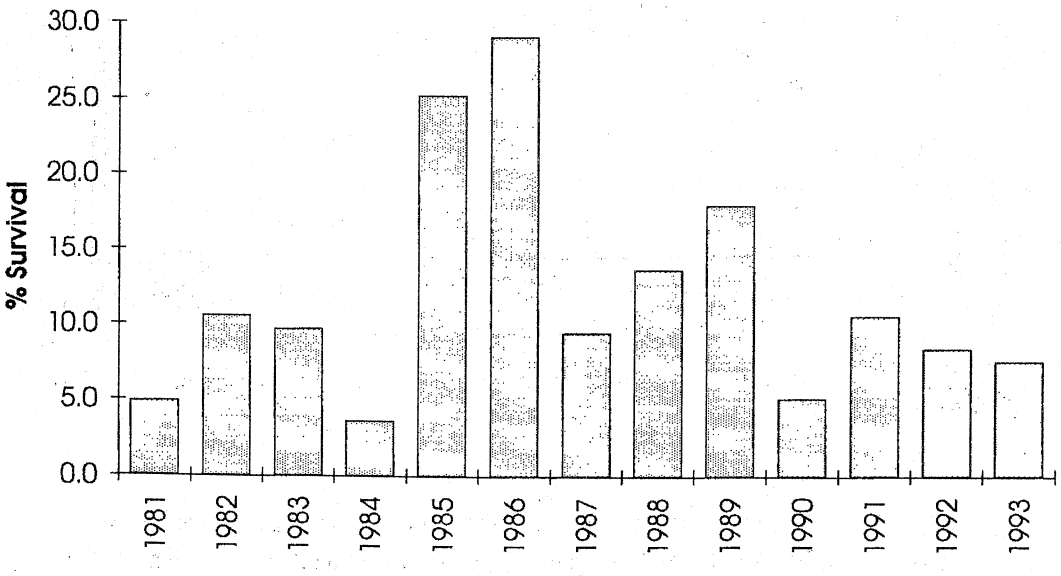


**Figure 4. Survival rate of Burrishoole reared smolts to the Irish coast.**

The percentage survival of the hatchery stock (i.e. rate of return to the river from the total number of smolts released) also remained relatively stable varying from 0.5% to 4% with a mean of 2.5% (Table 2). Survival to the coast in 1993 from smolt migration prior to homewater exploitation was 7.5% which was lower than the mean of 12% for this period.

The relationship between the total number of microtagged smolts released and the subsequent return to the coast prior to commercial homewater exploitation is shown in Figure 5. The relationship is significant at the 95% confidence level and 54 % of the variation in the model is explained by this relationship.

Marine mortality, independent of fishing exploitation, and differences between release groups in terms of husbandry, timing of release and release conditions would account for a high proportion of the variation. Therefore, a more thorough analysis of the database of tag recovery information, which takes account of the known differences between release groups, may improve this relationship considerably.

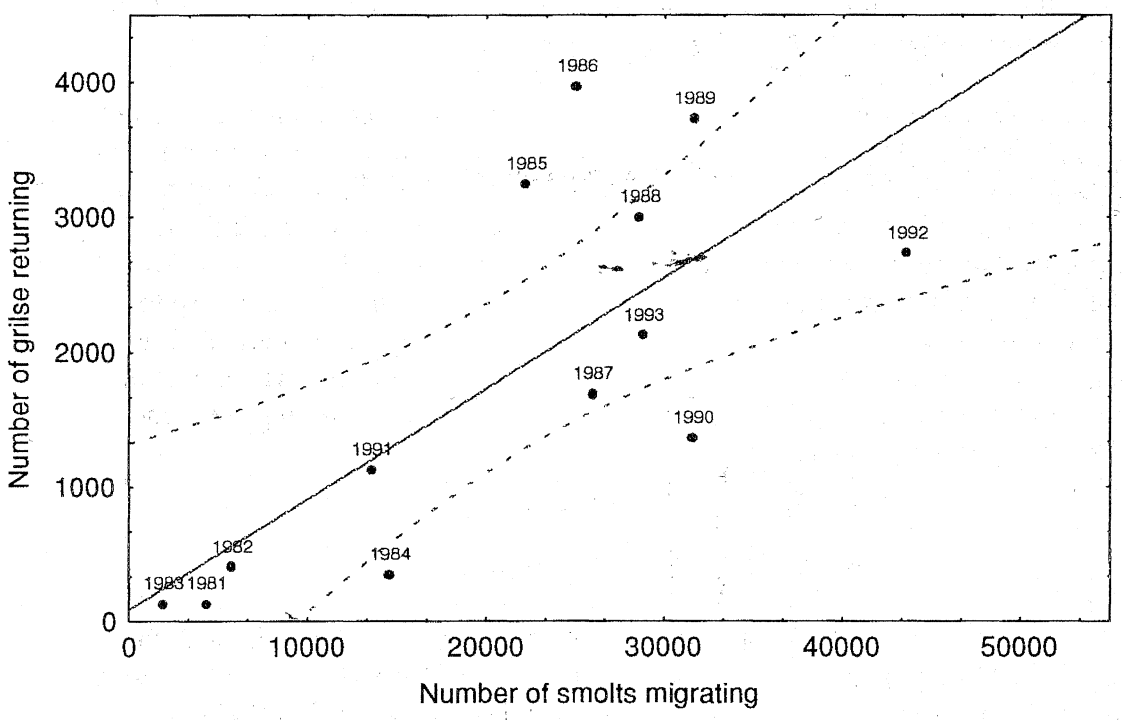


**Figure 5. Relationship between numbers of microtagged smolts migrating and subsequent return as grilse to Irish coastal waters**

The rate of exploitation in the high seas fisheries was extremely low for the Burrishoole stock. While tags originating from Burrishoole releases often appeared in the Faroese long-line fishery, these invariably originated from discarded fish (less than 60 cm) and the extant exploitation rate (i.e. the numbers of fish taken in the fishery over the numbers of fish deemed to be alive at that time) only exceeded 1% in one season (1987/1988) since microtagging was initiated in 1980 (Anon. 1994). The rate of recovery of Burrishoole

microtags in the Greenland drift net fishery was also sporadic and generally very low, and it is not possible to use these tag recoveries to estimate exploitation accurately. However, tags recovered from this fishery were from 1 sea-winter salmon, which are destined to return to Irish waters as 2 sea-winter salmon. Therefore, even a low rate of tag recovery can indicate a relatively high rate of exploitation as this component of the stock is always small.

## DISCUSSION

Browne and Piggins (1986) reported that exploitation on this hatchery stock was high but relatively constant for the period 1981 to 1985. It appears from more recent tag recovery estimates that the exploitation rate is declining. This may be the result of several factors, including lower fishing effort, as fishermen generally perceive stocks to be low, lower prices for wild salmon and increased fishery protection in recent years, particularly in the north and north west.

Return rates are influenced not only by the numbers of smolts released but also by marine mortality factors and differences in release groups. Marine mortality (thermal habitat, predation etc) cannot be controlled but husbandry techniques and release strategies can be adjusted and this may improve return rates overall.

Exploitation on this stock has always been very low in the Faroes fishery (Anon. 1994) and it is unlikely that the recent buyout of the quota of this fishery will be noticed in return rates in Irish waters. Browne and Piggins indicate that exploitation by the Greenland fishery may be high on potential Irish 2 sea-winter stocks. The recent buyout of the Greenland quota may yield considerably more 2 sea-winter salmon to the Burrishoole and other fisheries. However, the first salmon returns to Ireland resulting from this buyout will not return to Irish coastal and inshore waters until 1994. As these fish generally return as early spring fish, they are not subjected to coastal exploitation at the same rate as 1 sea-winter salmon. This should therefore result in considerably more 2 sea-winter salmon entering rivers and higher numbers being taken by anglers.

## ACKNOWLEDGEMENTS

We are indebted B. Doolan and N. Bond (Fisheries Research Centre) who assist with the National Coded Wire Tagging and Recovery Programme and the many bursar students who have participated in the programme. Staff of the Salmon Research Agency of Ireland (formerly the Salmon Research Trust of Ireland) are gratefully acknowledged for providing recovery information for the trap facility and the catchment in general and also for providing invaluable assistance during tagging operations. Declared salmon landings are provided by the Regional Fisheries Board Managers for each of the seven Regional Fisheries areas and by the Foyle Fisheries Commission. This programme could not have been carried out without the full co-operation and assistance of salmon dealers and processors to whom we are indebted.

## REFERENCES

Anon. (1994). Report of the Meeting of the Working Group on North Atlantic Salmon. *ICES CM 1994, ASSESS.*

Browne, J and Piggins D. J. (1986). Exploitation of Reared Salmon Released into the Burrishoole River System. *ICES CM 1986 / M:21.*

Piggins, D. J. (1985). The Silver eel run of the Burrishoole System. *ICES CM 1985/M:5.*

Table 1. Estimated number of tagged salmon recaptured in each fishing area (Tag recoveries x ratio of total catch to number of fish examined)

| Fishery year | Number migrating | Donegal | Mayo | Gal/Lim | Kerry | Cork | South coast | South east coast | Total freshwater | Total nets | TOTAL RETURNS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1981 | 4,353 | 13 | 17 | 18 | 0 | 3 | 0 | 0 | 81 | 51 | 132 |
| 1982 | 5,767 | 155 | 131 | 18 | 17 | 3 | 3 | 0 | 77 | 327 | 404 |
| 1983 | 1,923 | 46 | 46 | 5 | 2 | 0 | 0 | 0 | 32 | 99 | 131 |
| 1984 | 14,588 | 116 | 84 | 50 | 15 | 0 | 0 | 0 | 79 | 265 | 344 |
| 1985 | 22,197 | 374 | 786 | 904 | 422 | 0 | 0 | 6 | 750 | 2,492 | 3,242 |
| 1986 | 25,039 | 379 | 962 | 500 | 863 | 11 | 168 | 89 | 1,000 | 2,972 | 3,972 |
| 1987 | 25,985 | 204 | 544 | 350 | 26 | 6 | 2 | 18 | 541 | 1,150 | 1,691 |
| 1988 | 28,611 | 1,430 | 264 | 213 | 5 | 0 | 45 | 56 | 985 | 2,013 | 2,998 |
| 1989 | 31,653 | 663 | 905 | 924 | 152 | 7 | 6 | 32 | 1,040 | 2,688 | 3,728 |
| 1990 | 31,619 | 239 | 178 | 162 | 6 | 0 | 0 | 0 | 778 | 585 | 1,363 |
| 1991 | 13,599 | 142 | 382 | 91 | 9 | 0 | 0 | 0 | 502 | 624 | 1,126 |
| 1992 | 43,608 | 387 | 1,081 | 68 | 117 | 0 | 0 | 0 | 1,076 | 1,653 | 2,729 |
| 1993 | 28,842 | 144 | 691 | 57 | 24 | 99 | 0 | 0 | 632 | 1,015 | 1,647 |
| Mean | 21,368 | 330 | 467 | 258 | 127 | 10 | 17 | 15 | 583 | 1,226 | 1,808 |

Table 2 Percentage exploitation and survival to the river of Burrishoole reared grilse. ( Return to river = rod catch + count; NCFM = non-catch fishing mortality)

| Fishery year | Return to river | Exploitation by nets | Exploitation by nets including NCFM | Survival to river from release | Survival to coast including NCFM |
|---|---|---|---|---|---|
| 1981 | 61.4 | 38.6 | 62.1 | 1.9 | 4.9 |
| 1982 | 19.1 | 80.9 | 87.3 | 1.3 | 10.5 |
| 1983 | 24.4 | 75.6 | 82.8 | 1.7 | 9.7 |
| 1984 | 23.0 | 77.0 | 84.9 | 0.5 | 3.6 |
| 1985 | 23.1 | 76.9 | 86.5 | 3.4 | 25.1 |
| 1986 | 25.2 | 74.8 | 86.2 | 4.0 | 28.9 |
| 1987 | 32.0 | 68.0 | 77.9 | 2.1 | 9.4 |
| 1988 | 32.9 | 67.1 | 74.6 | 3.4 | 13.6 |
| 1989 | 27.9 | 72.1 | 81.6 | 3.3 | 17.9 |
| 1990 | 57.1 | 42.9 | 51.6 | 2.5 | 5.1 |
| 1991 | 44.6 | 55.4 | 65.0 | 3.7 | 10.5 |
| 1992 | 39.4 | 60.6 | 70.6 | 2.5 | 8.4 |
| 1993 | 38.4 | 61.6 | 70.8 | 2.2 | 7.5 |
| Mean | 34.5 | 65.5 | 75.5 | 2.5 | 11.9 |